Sept. 18, 1934. C. A. THOMAS ET AL 1,973,734

FIRE EXTINGUISHER

Filed May 29, 1929

FIG. 1

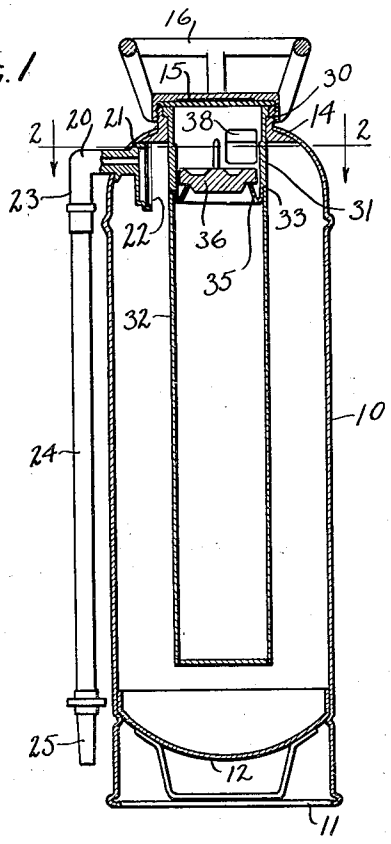


FIG. 3

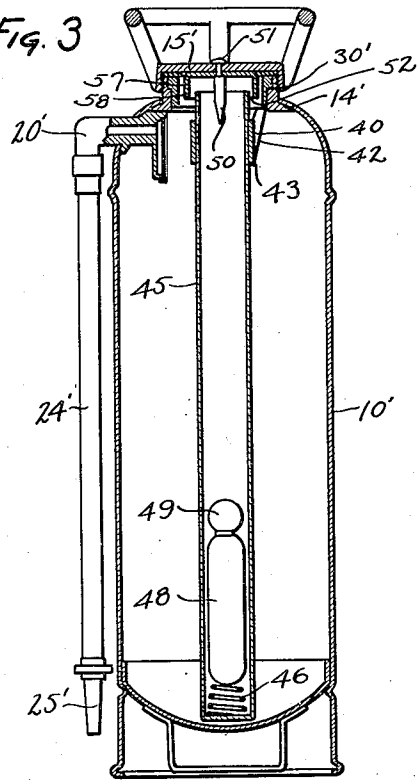
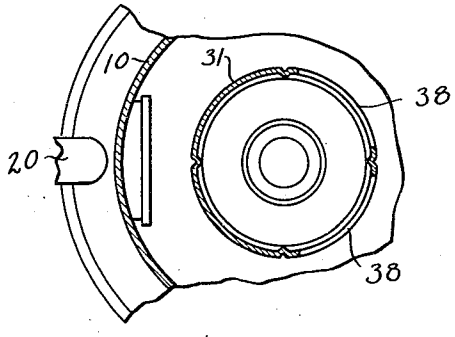


FIG. 2



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FIRE EXTINGUISHER

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20 Claims. (Cl. 23—11)

This invention relates to fire extinguishers of the foam type and more particularly to charges for use in such fire extinguishers.

It is among the objects of this invention to provide a charge for fire extinguishers of the foam type which has unusual and superior fire-extinguishing properties and sufficient to meet the present requirements for such extinguishers.

Another object of this invention is to provide a charge for fire extinguishers of the foam type which is non-freezing at extremely low temperatures and which reacts with high efficiency to generate an extinguishing foam at such low temperatures.

Still another object of the invention is to provide a superior method of extinguishing fire, utilizing the above charge.

Other objects and advantages of this invention will be apparent from the following disclosure.

In the drawing, in which like characters of reference designate like parts throughout the several views thereof,

Fig. 1 is a vertical sectional view of a form of foam extinguisher which functions very satisfactorily for receiving a charge prepared in accordance with this invention;

Fig. 2 is a horizontal sectional view taken on the plane of the line 2—2 of Fig. 1; and

Fig. 3 is a vertical sectional view of a modified form of extinguisher which will function satisfactorily for receiving a foam charge of this invention where a sealed acid bottle is desirable.

Charges for foam extinguishers, as heretofore used, generally comprised an outer basic solution containing a gas-generating material, ordinarily sodium bicarbonate, and a "foam stabilizer" such as extract of licorice, and an inner solution of aluminum sulphate. When put into use, a chemical reaction takes place between the acid salt of aluminum and the gas-generating material which produces a gaseous pressure for expelling the fire-extinguisher fluid, and due to the presence of the foam stabilizer, a tenacious and lasting foam which is discharged from the extinguisher; the aluminum hydroxide formed during the reaction being said to provide a "latticework" for the foam.

We have discovered that the fire-extinguishing properties of a foam extinguisher may be materially increased above the heretofore-known extinguishing characteristics by the introduction of certain compounds into the foam-producing solutions, which compounds involve a certain group of elements, and which we have found to possess unusual or special advantages from the fire extinguishing standpoint. To this effect we have discovered that the fire-extinguishing properties of a foam charge may be materially increased by incorporating therein a compound of an element of group I of the periodic table of elements. Particularly, those elements of group I which have the higher atomic weights and which are positioned below sodium in the arrangement of the periodic table, namely, potassium, rubidium and caesium, possess unusually efficacious fire-extinguishing qualities. In general, these elements, when combined with a radical, either organic or inorganic, present a group of substances which prove upon test to have peculiarly advantageous fire-extinguishing properties.

For example, we have found that a compound composed of the element potassium, which is one of the elements of group I referred to, combined with an organic radical such as a lactate, will constitute an excellent material to be added to the basic solution of a foam charge. Other compounds of potassium, or of other elements of group I of the periodic table, may be substituted for the potassium lactate to give the desirable high fire-extinguishing properties to the extinguishing foam. Thus, other organic compounds of the elements referred to, such as other members of the carboxylic acid class and its various subclasses which embrace for example the formates, acetates, stearates, oxalates and tartrates, possess these exceptional fire-extinguishing properties. Also, inorganic compounds of these elements such as the halogen compounds including the chloride, bromide, iodide and fluoride, and especially the oxygenated compounds of the halogens such as the chlorate, the nitrates and the nitrites, all possess these high fire-extinguishing properties to an unusual degree. While sodium compounds are generally inferior to potassium, rubidium and caesium as regards fire-extinguishing effect, we have discovered certain compounds of sodium, such as sodium acetate, sodium lactate and sodium nitrate, have special or unusual fire-extinguishing qualities.

These compounds, such as potassium lactate, should be introduced into the foam producing solution in sufficient amount to provide a relatively high metal content, such as a high potassium content, to get the best extinguishing effects. The foam produced when such materials are present in substantial quantities to materially increase the fire-extinguishing properties of the foam, for example in excess of 10% by weight is generally a so-called "wet" foam, comprising ad-

hering bubbles of gas which carry along suspended particles of liquid, and the liquid in these instances is of high fire-extinguishing effect due to the presence of such compounds having unusual extinguishing qualities. A superior extinguishing effect of the foam is obtained by the introduction into the generated foam of finely divided or dispersed drops of a rather concentrated solution of one of these alkali metal compounds having inherently exceptional fire-extinguishing properties. The superior results may be obtained from a combination of the smothering effect of the foam blanket and an extinguishing effect of the entrained particles of solution of these compounds carried along with the foam.

The use of these compounds, such as potassium lactate provides important advantages other than the superior fire-extinguishing effect. Potassium lactate, for example, materially depresses the freezing point of the solution, thus serving as a freezing temperature depressant. By using sufficient quantities of potassium lactate, which may approach the point of saturation, a solution is obtained which will withstand extremely low temperatures of the order of —20° C. and below and still not affect the foam producing qualities of the solution. Moreover, the presence of potassium lactate in the solution provides for the generation of a good foam comparable, from the practical viewpoint, with the foam produced through the use of aluminum salts, which, as stated above, are adapted to form the "latticework" upon which the foam builds or is supported to provide a more tenacious and lasting foam. Sodium lactate may be used in place of potassium lactate, and give the advantages of increased fire-extinguishing properties, the latticework effect to obtain a tenacious foam, and the lowering of the freezing point of the solution. We prefer to use potassium lactate as the fire-extinguishing properties of this compound are even superior to those of sodium lactate. Any suitable gas-generating material, such as a suitable carbonate, and any suitable foam stabilizer, such as extract of licorice, may be used to provide this superior foam forming composition.

Any suitable gas-generating material which is not too strongly alkaline in water solution may be used in this composition. We have found that a strongly alkaline material, such as potassium carbonate, is not so satisfactory in a foam charge. While such a carbonate will produce the necessary carbon dioxide gas, the strong alkalinity of the solution tends to destroy the foam. Carbonates which do not have this strong alkaline reaction are quite satisfactory. Very satisfactory results have been obtained with sodium bicarbonate. The alkali metal compound having inherently exceptional fire-extinguishing properties should also not be sufficiently alkaline to destroy the foam. An alkalinity materially less than that of potassium carbonate is not objectionable. The composition may be shipped to the user in the form of a powder and then dissolved in water to produce the basic solution of a foam charge, or the basic solution may be initially formed and shipped to the user.

In order to still further depress the freezing point of this basic solution, any suitable freezing temperature depressant material, which is chemically inert with respect to the basic solution, may be used. Ethylene glycol is a very suitable material for this purpose, as relatively small amounts serve to lower the freezing point of the basic solution containing a potassium salt, or other salt or salts referred to having high fire-extinguishing properties as well as freezing temperature depressant properties, to extremely low temperatures to render the basic solution non-freezing in very cold climates. Ethylene glycol is free flowing or of sufficiently low viscosity at such extremely low temperatures to permit its use in this capacity. Alkali metal acetates are also exceptionally good freezing temperature depressants, and these materials serve in addition to increase the fire-extinguishing properties of the solution. Thus we have found potassium acetate to be highly effective for this purpose, and when used in conjunction with potassium lactate in certain proportions, a solution is obtained which has a freezing point below —40° C., which is sufficiently low to meet the requirements of Underwriters' Laboratories to obtain a preferred rating.

As examples of basic solution charges prepared in accordance with our invention, the following may be mentioned. Where the charge need not withstand unusually severe winter temperatures, the following provides a very satisfactory solution:—

	Percent by weight
Potassium lactate	30
Sodium bicarbonate	8
Extract of licorice	2
Water	60

Approximate freezing point —22° C.

Both potassium lactate and sodium lactate may be used in the basic charge as illustrated in the following example:—

	Percent by weight
Potassium lactate	30
Sodium lactate	15
Sodium bicarbonate	10
Extract of licorice	2
Water	43

Approximate freezing point —24° C.

As an example using ethylene glycol the following is mentioned:—

	Percent by weight
Potassium lactate	35
Sodium bicarbonate	10
Extract of licorice	2
Ethylene glycol	5
Water	48

Approximate freezing point —26° C.

As illustrating the superior depressant effect of alkali metal acetates in this basic charge, the following examples utilizing potassium acetate in addition to potassium lactate are mentioned:—

	Percent by weight
Potassium lactate	36
Sodium bicarbonate	9
Potassium acetate	9
Extract of licorice	2
Water	44

Approximate freezing point —35° C.

	Percent by weight
Potassium lactate	36
Sodium bicarbonate	9
Potassium acetate	12
Extract of licorice	2
Water	41

Approximate freezing point —42° C.

The basic solution may be used with any acid liquid or solution of any acid salt which will react with the gas-generating material to produce the expelling gas. For example, an ordinary solution of aluminum sulphate may be used as the acid liquid.

Referring to the drawing, there is disclosed in Figs. 1 and 2 a preferred embodiment of portable fire-extinguishing apparatus, which is adapted to be used when a relatively large volume of acid liquid is contained in the charge, such as when an aluminum sulphate solution is used. This extinguisher comprises a sheet metal container 10 having a portion 11 with a flat face which serves as a base on which the container may set when not in use. The lower end of the container is closed by a sheet metal bottom 12 which may be fastened to the wall of the outer shell in any suitable manner such as by soldering. The top end is provided with a centrally arranged opening which receives therein a cover casting 14 to which this end of the shell 10 is soldered. The upper end of the cover casting 14 is threaded to receive thereon a cover member 15 carrying a suitable handle 16, which as shown is in the form of a ring to serve as a base upon which the extinguisher is adapted to rest when inverted. Adjacent the upper end of the extinguisher and passing through the wall of the extinguisher shell is a discharge casting or fitting 20. This casting is provided with an enlarged shoulder 21 which is soldered to the shell. The inner end of the casting is provided with a flaring member receiving a screen 22, and the other end of the casting is formed as a threaded nipple 23 which receives the usual flexible hose 24 carrying a discharge nozzle 25.

The cover casting 14 is provided with an interior annular shoulder 30 upon which a cage-head casting 31 rests. An inner tube of sheet metal forming an inner container 32 is soldered to the cage head as at 33. This inner container is of sufficient capacity to hold the desired quantity of acid liquid, such as the aluminum sulphate solution. On the inner side of the cage head 31 is an inwardly and upwardly extending annular flange 35 forming a seat for a stopple 36, which stopple upon inversion of the extinguisher is adapted to fall away from the seat to permit the mixing of the acid solution in the inner container with the basic solution held within the outer container.

As shown clearly in Figs. 1 and 2, the cage head 31 is cut away above the stopple seat 35 and on the side opposite the discharge casting 20 to provide discharge ports 38 for the discharge of the acid liquid into the space within the outer container. The wall of the cage head 31 is left blank or imperforate on the side adjacent the discharge casting 20. This construction insures against any escape of unreacted acid through the discharge casting 20 ahead of the basic solution, so that full reactive capacity of the acid liquid is obtained to thereby insure the generation of the largest possible quantity of foam, while at the same time corrosion of materials upon which the fire-extinguishing fluid is sprayed due to the discharge of free acid from the extinguisher is effectively prevented.

In accordance with this invention, an acid such as chlorosulphonic acid, or other acid compound containing a sulphonic acid radical, is preferably substituted for the acid solution as above described. Such an acid withstands temperatures materially below —40° C. without freezing. When this acid is used in conjunction with a non-freezing basic solution as above referred to, a foam extinguisher is provided in which the normally separated portions of the charge are non-freezing and furthermore will react with high efficiency at extremely low temperatures. Such a foam charge will withstand temperatures of the order of —40° C. and lower, and the separate portions of the charge are chemically active with respect to each other to generate an extinguishing foam with high efficiency at such low temperatures. Only a relatively small volume of chlorosulphonic acid is required to provide a sufficient amount of the acid to generate the desired quantity of expelling gas. For example, about 2½ fluid ounces of chlorosulphonic acid is sufficient to react with and expel a gallon and a half of the basic solution in the form of a stabilized foam.

Referring to Fig. 3 of the drawing, a preferred form of portable extinguishing apparatus is disclosed, which is adapted to be used as a foam extinguisher when an acid such as chlorosulphonic acid is employed, where a sealed acid bottle is desirable. The outer shell, discharge casting and cover are constructed similarly to that previously described. In this construction, an annular ring member 40 is provided which rests upon a shoulder 30′ in the cover casting 14′. The member 40 is provided with downwardly and inwardly extending arms 42 connected at their lower ends with a cylindrical member 43, preferably formed integrally with the arms and annular ring. The cylindrical member 43 is open at the top and bottom and receives therein a sheet-metal tube or guide 45, the tube being rigidly connected to the ring 43 as by soldering. Positioned within the tube 45 and resting upon a cushioning spring 46 is a hermetically sealed acid bottle 48 having a frangible end 49, the bottle being of a capacity to hold the required volume of chlorosulphonic acid.

Carried by the cover 15′ in alignment with the tube 45 is a pointed projection 50, which is riveted to the cover at 51. Also carried by the cover 15′, is a cup-shaped member 57, held in place by the rivet 51. This member has a downwardly-extending tubular flange 58 which is concentric with and surrounds the upper end of the tube 45. This tubular extension is so spaced from the upper end of the tube 45 that a constricted annular passage 52 is formed therebetween through which the chemicals flow when being mixed to control the rate of mixing of the chemicals and to prevent the premature discharge from the extinguisher of acid unacted upon by the basic solution confined within the outer container 10′.

In referring above to the superior or exceptional fire-extinguishing characteristics of these various substances, we have had more particularly in mind comparison with the present-day requirements and conditions which have to be met in the specified tests outlined by Underwriters' Laboratories.

While the materials and compositions and method herein described constitute preferred embodiments of our invention, it is to be understood that the invention is not limited to these precise materials, compositions or method, and that changes may be made therein without departing from the scope of our invention as defined in the appended claims.

What is claimed is:

1. A fire extinguisher containing a liquid comprising a gas-generating material and a foam stabilizer, and a second liquid comprising a chemical adapted to react with the first liquid upon use

of the extinguisher to produce a stabilized foam, one of said liquids containing in addition a high concentration of a compound of an alkali metal element adapted to improve the fire-extinguishing qualities of the foam.

2. A fire extinguisher containing a liquid comprising a gas-generating material and a foam stabilizer, and a second liquid comprising a chemical adapted to react with the first liquid upon use of the extinguisher to produce a stabilized foam, one of said liquids containing in addition a high concentration of a compound of potassium adapted to improve the fire-extinguishing qualities of the foam.

3. A fire extinguisher containing a liquid comprising a gas-generating material and a foam stabilizer, and a second liquid comprising a chemical adapted to react with the first liquid upon use of the extinguisher to produce a stabilized foam, one of said liquids containing a high concentration of a compound comprising an alkali metal element combined with a carboxylic acid radical, said compound having inherently exceptional fire-extinguishing properties and adapted to improve the fire-extinguishing properties of the foam.

4. A fire extinguisher containing a liquid comprising a gas-generating material and a foam stabilizer, and a second liquid comprising a chemical adapted to react with the first liquid upon use of the extinguisher to produce a stabilized foam, one of said liquids containing an alkali metal lactate.

5. A fire extinguisher containing a liquid comprising a gas-generating material and a foam stabilizer, and a second liquid comprising a chemical adapted to react with the first liquid upon use of the extinguisher to produce a stabilized foam, one of said liquids containing an alkali metal acetate.

6. A fire-extinguishing composition for foam extinguishers adapted to be reacted with an acid material with resultant production of a fire extinguishing foam, said composition comprising a carbonate, a foam stabilizer, and a compound of an alkali metal element other than a carbonate in an amount by weight in excess of the weight of the carbonate and adapted to improve the fire extinguishing qualities of the foam.

7. A fire-extinguishing liquid for foam extinguishers adapted to withstand low temperatures comprising a gas-generating material, a foam stabilizer, and an alkali metal compound of such character and in sufficient concentration to both materially lower the freezing point of the solution and to increase the fire-extinguishing properties of the foam.

8. A fire-extinguishing composition for foam extinguishers comprising a gas-generating material, a foam stabilizer, and an alkali metal lactate.

9. A fire-extinguishing composition for foam extinguishers comprising a gas-generating material, a foam stabilizer, and an alkali metal acetate.

10. A fire-extinguishing composition for foam extinguishers comprising a gas-generating material, a foam stabilizer, potassium lactate, and potassium acetate.

11. A fire-extinguishing composition for foam extinguishers comprising a gas-generating material, a foam stabilizer, an alkali metal lactate, and an alkali metal acetate.

12. A fire-extinguishing liquid for foam extinguishers adapted to withstand low temperatures, comprising water, a gas-generating material, a foam stabilizer, an alkali metal lactate, and an additional freezing temperature depressant chemically inert with respect to said other ingredients.

13. A fire extinguisher containing a liquid comprising a gas-generating material, and a second liquid comprising a sulphonic acid, one of said liquids containing a foam stabilizer, the sulphonic acid being chemically active with respect to said first mentioned liquid at temperatures approximating 0° C. and below to generate a fire-extinguishing foam.

14. A fire extinguisher containing a liquid comprising a gas-generating material, a foam stabilizer, and a freezing temperature depressant, said liquid being adapted to withstand extremely low temperatures without freezing, and an acid liquid adapted to withstand extremely low temperatures without freezing comprising a sulphonic acid, chemically active with respect to said first mentioned liquid at temperatures approximating 0° C. and below to generate a fire-extinguishing foam.

15. A fire-extinguishing composition for foam extinguishers, comprising sodium bicarbonate, a foam stabilizer, and a high concentration of a compound of an alkali metal element of group I of the periodic table having inherently exceptional fire-extinguishing properties and adapted to improve the fire extinguishing properties of the foam.

16. A fire-extinguishing composition for foam extinguishers, comprising sodium bicarbonate, a foam stabilizer, and a compound including potassium combined with a carboxylic acid radical.

17. A fire-extinguishing composition for foam extinguishers, comprising a carbonate which is not sufficiently alkaline in water solution to destroy the foam, a foam stabilizer, and a high concentration of an alkali metal compound improving the fire-extinguishing properties of the foam and which is not sufficiently alkaline to destroy the foam.

18. A fire extinguishing composition comprising a water solution containing an alkali metal lactate and an alkali metal acetate in a concentration to provide a freezing point of the solution below —40° C.

19. The method in the extinguishing of fire, which comprises reacting a gas generating material with an acid material in the presence of both a foam stabilizer and a solution of high concentration of an alkali metal compound having inherently exceptional fire extinguishing properties to produce a wet foam carrying dispersed drops of the solution containing the alkali metal compound in high concentration, and discharging the wet foam onto the fire so that the dispersed drops of the solution containing the alkali metal compound in high concentration carried along by the foam assist and improve the normal extinguishing action of the foam.

20. A fire-extinguishing composition for foam extinguishers comprising a gas-generating material, foam stabilizer, and an alkali metal lactate in sufficient concentration to materially lower the freezing point of the solution.

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